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Research Article

Ophiorrhiza liuyanii (Rubiaceae), a new species from south-western China and northern Vietnam

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Abstract

Ophiorrhiza liuyanii, a new species from south-western China and northern Vietnam, is described and illustrated. The new species is characterised by the glabrous surfaces on almost all plant parts, congested inflorescences and broad-ovate to ovate bracts 9–22 × 4–11 mm. It morphologically differs from the closest species, *O. baviensis*, mainly in most plant parts being glabrous, bracts broad-ovate to ovate, apex acute or sometimes obtuse, corollas inside with a ring of white hairs at the middle and anthers inserted near the middle in long-styled flowers. According to IUCN Categories and Criteria, *O. liuyanii* is assessed as Least Concern (LC).

Key words: New taxon, *Ophiorrhiza*, Rubiaceae, taxonomy

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Introduction

The genus *Ophiorrhiza* Linnaeus is an Indo-Malesian genus of Rubiaceae with species distributed in tropical and subtropical regions of Asia, with only a few extending to Australia, New Guinea and the Pacific Ocean (Tran 2005; Chen and Taylor 2011; Hareesh et al. 2015; Li 2020; Schanzer and Nabatov 2022; Shang et al. 2024). Representatives of this genus are annual or perennial herbs or rarely sub-shrubs, easily recognised by having obcordate and compressed fruits that are dehiscent with two valves along a transverse slit at the top (Darwin 1976; Lo 1990; Wu et al. 2015) and usually growing in moist locations or stream-sides under evergreen forests (Darwin 1976; Deb and Mondal 1997; Chen and Taylor 2011; Hareesh et al. 2015). In spite of the clear monophyly of the whole genus, based on capsule shape, the total species number of the genus is unclear and is estimated to be from 200 species (Lo 1999; Li 2020) to as many as 300 species (Alfeche et al. 2020; Taher et al. 2020; Zhou et al. 2020; Idrees et al. 2023) due to the lack of a worldwide revision.

China is a diversity centre of *Ophiorrhiza* with about 74 taxa recorded (Wu et al. 2017, 2018; Tu et al. 2018; Yang et al. 2018; Hu et al. 2021; Liu et al. 2023; Shang et al. 2024; Zhan et al. 2024). Most of Chinese *Ophiorrhiza* are distributed in southern and south-western China, particularly in Guangxi and Yunnan Provinces (Lo 1999; Chen and Taylor 2011). While examining *Ophiorrhiza* specimens at PE Herbarium in 2013, we found an unusual sheet with congested inflorescences, broadly ovate bracts and winged corolla outside. Due to the single specimen and lack of information inside the corolla, we tentatively treated it as *O. baviensis* Drake and thought that the difference in bracts might be a variable character within this species. In recent field surveys in Menghai County, south-western Yunnan, the peculiar plants of this species with fruits in 2014 and flowers in 2024 were observed and re-collected. After carefully examining fresh and dried material of the abovementioned species, we found that it is distinctly different from *O. baviensis* by the glabrous surfaces on most plant parts, larger bracts broad-ovate to ovate, the indumentum inside corollas and the placement of stigma and anthers (Wu et al. 2019). Further, from a comprehensive comparison between this peculiar plant with other known species of the genus, we concluded that it represents a new taxon, which is described hereafter.

Materials and methods

Field observations were carried out in south-western China in 2014 and 2024 and northern Vietnam in 2022. The morphological characteristics of a new *Ophiorrhiza* species were observed and measured in the field and laboratory. The morphological variations of 30 individuals were measured with a ruler and a micrometer. Specimens of the new species were preserved in the Forest Plant Herbarium (CSFI) of Central South University of Forestry and Technology and other herbaria (BNU, CSFI, HITBC, HN and LE). Acronyms for all herbaria in the text follow Thiers (2024). The conservation status of the new species was evaluated, based on field observations and referred to the IUCN Red List Guidelines (IUCN 2023).

Taxonomic treatment

***Ophiorrhiza liuyanii* L.Wu, Y.H.Tan & K.S.Nguyen, sp. nov.**

urn:lsid:ipni.org:names:77351093-1

Figs 1, 2A–K

Type. China • Yunnan Province: Menghai County, Mengsong Village, growing along a stream or on moist slopes under densely evergreen broad-leaved forests, 21°30'37.36"N, 100°30'17.33"E, elevation 1715 m, 13 Apr 2024 (fl.), *X.W. Liao LXW0217* (holotype: CSFI!; isotypes: CSFI!).

Diagnosis. Morphologically similar to *O. alatiflora* and *O. baviensis*, but the new species differs from the former by its congested (vs. developing) inflorescences and infructescences, broad-ovate to ovate (vs. linear or linear-lanceolate) bracts, 4–11 (vs. 0.8–1.5) mm wide and from the latter by its glabrous (vs. densely pubescent or puberulent) peduncles, broad-ovate to ovate (vs. lanceolate) bracts, corollas tube inside with (vs. without) a ring of white hairs at the middle in long-styled flowers.

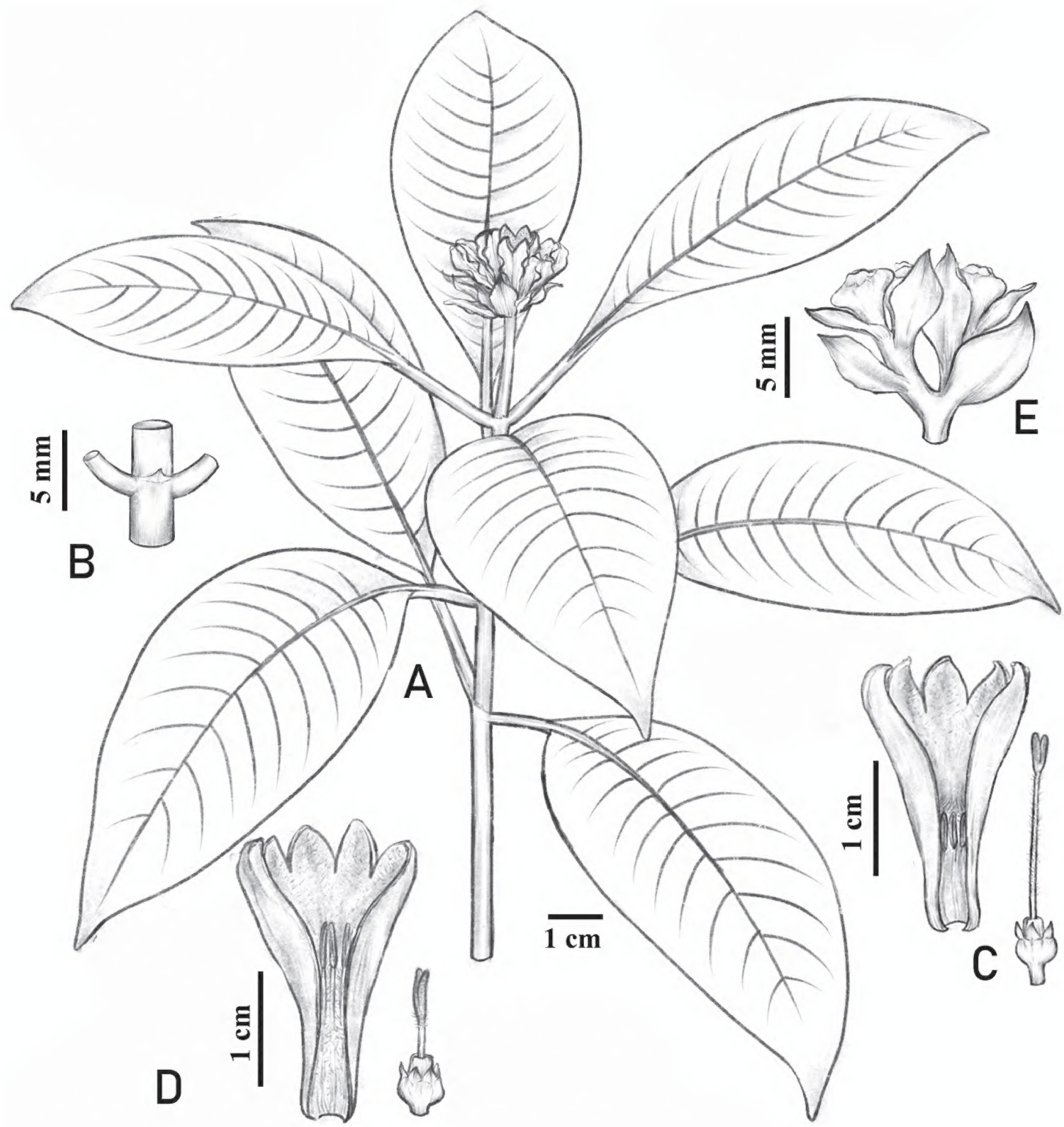

Figure 1. *Ophiorrhiza liuyanii* **A** flowering branch **B** stipule **C** longitudinally dissected short-styled flower **D** longitudinally dissected long-styled flower **E** infructescence in side view. Drawn from the holotype by M.M. Cheng.

Description. Perennial herbs, erect or ascending at the base, up to 80 cm tall; stem, leaves, petiole, stipule, bract, outside flower and capsule glabrous. Leaves generally in equal pairs (usually isophyllous); petioles 1–3 cm, pale green; leaf blades drying papery, dark green adaxially, pale green abaxially, elliptic, oblong or ovate-elliptic, 7–15 × 3–6 cm, cuneate at base, acuminate at apex, margins entire; secondary veins 9–13 at each side; stipules small, broadly triangular, ca. 1 mm long, caducous, with glands at the inner base. Inflorescences congested cymose, many-flowered, drooping at the early stage, then erect; peduncles 1–2 cm long, pale green; bracts broad-ovate to ovate, 9–22 × 4–11 mm, apex acuminate, acute or sometimes obtuse. Flowers heterostylous; pedicels to 3 mm long, puberulent.

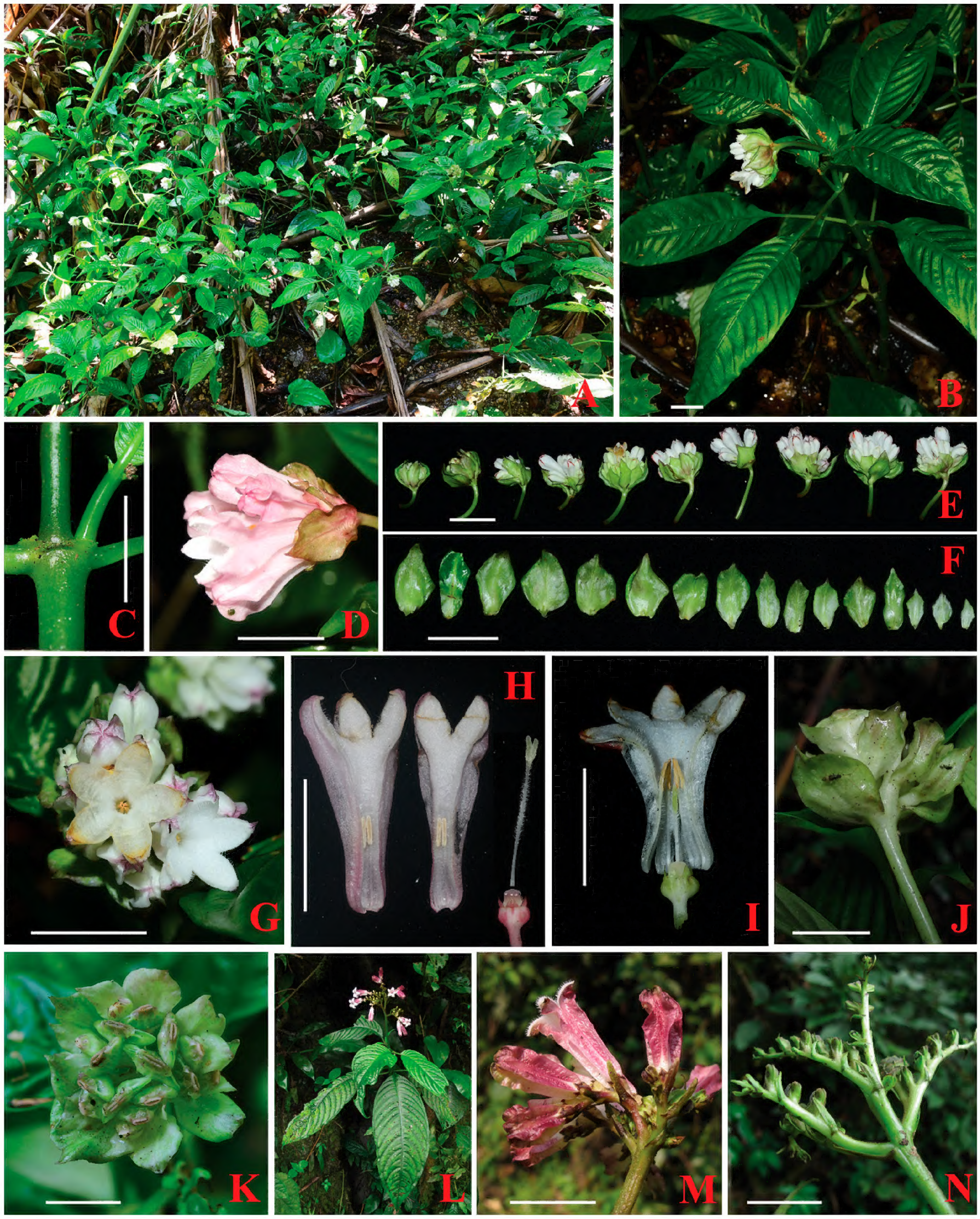

Figure 2. *Ophiorrhiza liuyanii* **A** habitat **B** habit **C** stipule **D** inflorescence in side view **E** inflorescences in different development stages **F** bracts from lower part to upper part of inflorescence **G** corollas in top view **H** longitudinally dissected long-styled flower **I** longitudinally dissected short-styled flower **J** infructescence in side view **K** infructescence in top view. *Ophiorrhiza alatiflora* **L** habit **M** inflorescence in lateral view **N** infructescence. Scale bars: 1 cm. Photos by L. Wu, X. W. Liao and K. S. Nguyen.

Calyx puberulent; hypanthium oblate, 1.5–1.8 × 1.8–2.2 mm; lobes triangular to ovate triangular, 0.8–1.6 mm long, acuminate at apex. Corolla white or pinkish-white, subtubular; tube 1.0–1.6 cm long, outside longitudinally winged from

apex to base, wings straight or undulate, ca. 0.8–2 mm wide; lobes 5, ovate-triangular, 3.8–4.8 × 2.8–3.5 mm, inside pubescent, apex acute, slightly incurved. Stamens 5; anthers linear, 2.2–3.2 mm long. Stigma bilobed; ovary 2-celled. Long-styled flowers: inside with a ring of white hairs at the middle of the corolla tube and puberulent from the middle up to the throat; stamens included, positioned a little below the middle of the corolla tube; style 8–12 mm long, densely pubescent; stigma positioned at the corolla throat, lobes elliptic, ca. 1.8 mm long. Short-styled flowers: sparsely pubescent at the middle of the corolla tube; stamens reaching slightly beyond corolla throat, not exserted; style 3.8–5.5 mm long, pubescent; stigma lobes lanceolate, ca. 2.8 mm long. Capsules mitriform, ca. 4.5 × 10 mm.

Phenology. Flowering from April to May; fruiting from May to July.

Distribution and habitat. *Ophiorrhiza liuyanii* is currently known from south-western China (Menghai County of southern Yunnan Province) and north-western Vietnam (Dien Bien Province). It grows along streams or moist places under evergreen broad-leaved forests at an elevation range from 1500–1850 m, in which the vegetation is dominated by the tree families Lauraceae, Fagaceae, Magnoliaceae, Theaceae and Betulaceae, shrub families Ericaceae and Symplocaceae and herbaceous families Urticaceae, Balsaminaceae and Begoniaceae.

Preliminary conservation status. Our field surveys revealed that three populations of *Ophiorrhiza liuyanii* have a total of matured individuals of ca. 5000 plants. The population of the holotype locality is the largest and is in good condition because their occupied area is included in the Nabanhe River Watershed National Nature Reserve and, during our 10 yearly re-visitation, we found the habitats had been well-protected. Therefore, the new species is preliminarily assessed as Least Concern (LC) according to IUCN (2023).

Etymology. The species epithet is named after Prof. Yan Liu, Guangxi Institute of Botany, Guangxi Zhuangzu Autonomous Region and the Chinese Academy of Sciences, who has made great contributions to plant taxonomy in China.

Chinese name. 宽翅蛇根草 (kuan-chi-she-gen-cao).

Additional specimens examined (*paratypes*). China • Same village as holotype, elevation 1700 m, 2 Apr 2001 (fl.) H. Wang 4311 (PE 2014155!), elevation 1500 m, 7 Jun 2014 (fr.), L. Wu 3706 (BNU! CSFI!), 21°30'42.43"N, 100°30'18.73"E • elevation 1700 m, 13 Apr 2024 (fl.), X.W. Liao LXW0219 (CSFI!), 21°30'27.65"N, 100°30'27.12"E • elevation 1695 m, 13 Apr 2024 (fl.), X.W. Liao LXW0220 (CSFI!).

Vietnam • Dien Bien Province: Muong Nhe Distr., Muong Nhe Natural Reserve, Sin Thau Municipality, Ta Mieu Village, around point 22°24'02"N, 102°08'38"E, elevation 1800–1850 m, old humid secondary evergreen broad-leaved montane forest of very steep mountain slopes composed of sandstone, terrestrial herb to 0.5 m tall, flower pinkish-white, common, 14 May 2022, L. Averyanov, H.T. Tran, K.S. Nguyen, H.C. Nguyen, T. Maisak, C.K. Bac, VR 1637 (HN!, LE!).

Notes. *Ophiorrhiza liuyanii* is morphologically most similar to *O. baviensis* on having congested inflorescences and distinct, persistent bracts. However, the former differs from the latter mainly by its glabrous (vs. pubescent or puberulent) stems, peduncles and calyx (Figs 2B, C, D, E, 3E, F), broad-ovate to ovate (vs. lanceolate) bracts with larger in size, 9–22 × 4–11 (vs. 6–15 × 2–7) mm (Figs 2D–F, 3C, D, G), corolla tubes inside with (vs. without) a ring of white hairs at the middle and anthers positioned near the middle (vs. base) in long-styled flowers (Figs 2H, I, 3E, F). The new species also resembles *O. alatiflora* by having wings longitudinally and wider than 0.8 mm outside corolla, but it clearly differs by its congested (vs. developing)

Figure 3. *Ophiorrhiza baviensis* **A** habit **B** inflorescence in top view **C, D** inflorescence in side view **E** longitudinally dissected long-styled flower **F** longitudinally dissected short-styled flower **G** infructescence in top view. Scale bars: 1 cm. Photos by L. Wu.

Table 1. Morphological comparison of *Ophiorrhiza liuyanii*, *O. alatiflora* and *O. baviensis*.

	Ophiorrhiza liuyanii	***O. alatiflora***	***O. baviensis***
stem	glabrous	glabrous	glabrous to densely pubescent
peduncles	glabrous	glabrous	densely pubescent or puberulent
inflorescence	congested	congested when young, then developing when matured	congested
bracts	broad-ovate to ovate, 9–22 × 4–11 mm, apex acute or sometimes obtuse, glabrous	linear or linear-lanceolate, 5–15 × 0.8–1.5 mm, apex acute, glabrous	lanceolate, 6–15 × 2–7 mm, apex accumulate, puberulent or ciliate
calyx	glabrous	puberulent	pubescent, sometimes densely
corolla	subtubular	subtubular	tubular, slightly swollen at base
long-styled flowers inside	inside with a ring of white hairs at the middle	inside with a ring of white hairs at the middle	inside densely pubescent, but without a ring of white hairs at the middle
anthers and stigma	inserted near the middle and the throat of corolla tube in long-styled flowers respectively, while opposite in the short-styled flowers	inserted near the middle and the throat of corolla tube in long-styled flowers respectively, while opposite in the short-styled flowers	inserted near the base and above middle of corolla tube in long-styled flowers respectively, while opposite in the short-styled flowers

inflorescences and infructescences (Figs 2B, D, E, J, K, M, N), broad-ovate to ovate (vs. linear or linear-lanceolate) bracts, 4–11 (vs. 0.8–1.5) mm wide (Figs 2F, J, K, N). Further distinctive characteristics of the three species are shown in Table 1.

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

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Data availability

All of the data that support the findings of this study are available in the main text.

References

Alfeche NKG, Alejandro GJD, Meve U, Liede-Shumann S (2020) Two new endemic species of *Ophiorrhiza* L. (Rubiaceae: Ophiorrhizeae) from Davao Oriental, Philippines. Nordic Journal of Botany 38(3): e02581. https://doi.org/10.1111/njb.02581

Chen T, Taylor CM (2011) *Ophiorrhiza*. In: Wu ZY, Raven PH, Hong DY (Eds) Flora of China (Vol. 19). Science Press, Beijing & Missouri Botanical Garden Press, St. Louis, 258–282.

Darwin SP (1976) The Pacific species of Ophiorrhiza L. (Rubiaceae). Lyonia 1: 48–101. https://doi.org/10.3897/phytokeys.121.30570

Deb DB, Mondal DC (1997) Taxonomic revision of the genus *Ophiorrhiza* L. (Rubiaceae) in Indian subcontinent. Nelumbo 39: 1–148. https://doi.org/10.20324/nelumbo/v39/1997/74298

Hareesh VS, Sreekumar VB, Kumar KMP, Nirmesh TK, Sreejith KA (2015) *Ophiorrhiza sahyadriensis* (Rubiaceae), a new species from southern Western Ghats, Kerala, India. Phytotaxa 202(3): 219–224. https://doi.org/10.11646/phytotaxa.202.3.6

Hu YH, Liu WJ, Song XF, Deng GX, Nakamura K, Wu L, Liu QR (2021) A discussion of the relationship between *Ophiorrhiza exigua* and *O. michelloides* (Rubiaceae) with the description of a new species. Nordic Journal of Botany 39(6): e03138. https://doi.org/10.1111/njb.03138

Idrees M, Li M, Zhang Z (2023) Transfer of six species of *Spiradiclis* Blume to *Ophiorrhiza* L. (Rubiaceae). Phytotaxa 579(3): 225–227. https://doi.org/10.11646/phytotaxa.579.3.8

IUCN (2023) Guidelines for using the IUCN Red List categories and criteria, version 14. Prepared by the Standards and Petitions Committee. https://www.iucnredlist.org/resources/redlistguidelines [Accessed 28 July 2023]

Li DZ (2020) The Families and Genera of Chinese Vascular Plants (Vol. III). Science Press, Beijing, 1761 pp.

Liu Q, Chen AX, Liao XW, Liu QR, Wu L (2023) *Ophiorrhiza pseudonapoensis* (Rubiaceae), a new species from Yunnan, southwestern China. Phytotaxa 607 (4): 228–234. https://doi.org/10.11646/phytotaxa.607.4.1

Lo HS (1990) Taxonomic revision of the Chinese species of *Ophiorrhiza* (Rubiaceae). Bulletin of Botanical Research 10(2): 1–82.

Lo HS (1999) *Ophiorrhiza*. In: Lo HS (Ed.) Flora Reipublicae Popularis Sinicae (Vol. 71(1)). Science Press, Beijing, 110–174.

Schanzer IA, Nabatov AA (2022) Taxonomic reassessment and lectotypification of 24 species names in *Ophiorrhiza* (Rubiaceae, Rubioideae) from Thailand. Nordic Journal of Botany 2022(2): e03280. https://doi.org/10.1111/njb.03280

Shang C, Xue J, Yang Y, Liao X, Liu Q, Wu L (2024) *Ophiorrhiza reflexa* (Rubiaceae), a new species from a karst region in Guangxi, China. PhytoKeys 238: 231–240. https://doi.org/10.3897/phytokeys.238.116767

Taher M, Shaari SS, Susanti D, Arbain D, Zakaria ZA (2020) Genus *Ophiorrhiza*: a review of its distribution, traditional uses, phytochemistry, biological activities and propagation. Molecules 25: 2611. https://doi.org/10.3390/molecules25112611

Thiers B (2024) Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. Available from: http://sweetgum.nybg.org/science/ih/ [accessed 12 August 2024]

Tu RH, Li JL, Wu L, Hareesh VS (2018) *Ophiorrhiza gaoligongensis* (Rubiaceae), a new species from southwestern China. Novon 26(4): 351–354. https://doi.org/10.3417/2018309

Wu L, Wang JL, Liu QR (2015) *Spiradiclis pauciflora* (Rubiaceae), a new species from limestone areas in Guangxi, China. Annales Botanici Fennici 52: 257–261. https://doi.org/10.5735/085.052.0318

Wu L, Deng YF, Tan YH (2017) Notes on Ophiorrhiza hispida (Rubiaceae) from China. Journal of Tropical and Subtropical Botany 25: 597–600. https://doi.org/10.11926/JTSB.3750

Wu L, Tan YH, Hareesh VS, Liu QR (2018) *Ophiorrhiza macrocarpa* (Rubiaceae), a new viviparous species from Yunnan, south western China. Nordic Journal of Botany 36(4): 1–5. https://doi.org/10.1111/njb.01637

Wu L, Liu WJ, Nguyen KS (2019) Revision of three taxa of *Ophiorrhiza* (Rubiaceae) from China. Phytotaxa 87: 129–139. https://doi.org/10.11646/phytotaxa.387.2.5

Yang CD, He XZ, Gou GQ (2018) *Ophiorrhiza guizhouensis* (Rubiaceae), a new species from Guizhou Province, southwestern China. PhytoKeys 95: 121–126. https://doi.org/10.3897/phytokeys.95.22506

Zhan M, Liao XW, Song F, Xue L, Liu QR, Wu L (2024) *Ophiorrhiza paralatiflora* (Rubiaceae), a new species from limestone areas in Guangxi, China. Nordic Journal of Botany 2024(7): e04391. https://doi.org/10.1111/njb.04391

Zhou SS, Li R, Quan RC, Shine L, Duan LD (2020) *Ophiorrhiza monsvictoriae* (Rubiaceae, Rubioideae), a new species from Myanmar. In: Jin XH, Xia NH, Tan YH (Eds) Plant diversity of Southeast Asia-II. PhytoKeys 138: 219–223. https://doi.org/10.3897/phytokeys.138.38966